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augmented. But soundness and accuracy of judgment and practical tact are impossible without some knowledge of the relationships which our own department of inquiry bears to others, and it is this general knowledge as based upon historical and biographical studies that Dr. Griesbach has endeavored to supply. By indicating at all points the intimate connexion obtaining between the various physical sciences, and by emphasising the continuity and solidarity of their development he has striven to furnish a secure and broad foundation for subsequent special studies. While the work is designed more expressly for chemists, physicians, and pharmacists, and consequently deals more particularly with the relations of physics and chemistry to bacteriology and medicine, it possesses nevertheless an entirely independent value as a well correlated introduction to science at large. The publishers have done much to provide for a practical form of typographical presentation, and the numerous illustrations of instruments, etc., have been gathered at a considerable expense from leading text-books, works of original inquiry, periodical literature, etc. The bibliographies which the author has added to each subject have been made with knowledge and skill, and render the work also an invaluable one for purposes of reference.

STUDIES: SCIENTIFIC AND SOCIAL. By *Alfred Russel Wallace, LL. D., D. C. L., F. R. S.*, etc. In two volumes. With numerous illustrations. London: Macmillan and Co., Limited. New York: The Macmillan Company. 1900. Pages, Vol. I., xv, 532; Vol. II., viii, 535. Price, $5.00.

Mr. A. R. Wallace has done well to collect in book form the various more important articles he has contributed to reviews and other periodicals, seeing that they were intended to be, as he calls them, "studies" dealing with problems of great moment, not merely scientific, but educational, political, and social, in which he is greatly interested. The book is not, however, a mere reprint. In order to make the subjects treated of as interesting as possible to the general reader, the author has introduced copious illustrations, and in many cases has considerably modified and enlarged the original article, the whole receiving careful revision. The subjects are arranged in classes, which fall into the two categories of Scientific and Social, to the former of which volume one of the work is devoted, the second volume being confined to social questions. Some reference will have to be paid to these, but the subjects discussed in the first volume will necessarily engage our chief attention. They are classed under the heads of "Earth Studies," "Descriptive Zoology," "Plant Distribution," "Animal Distribution," "Theory of Evolution," "Anthropology," and "Special Problems." We have here scope for a wide range of discussion, but all the questions considered are closely related as phases of the all-important subject of evolution, taking this term in its widest sense as applicable to the earth and its inhabitants.

The theory of evolution, with which Mr. Wallace is specially associated, is dealt with in four chapters, reference to which we will make in their order. The first, which is chapter fourteen of volume one of the general work, deals with "The origin of Species and Genera," and it begins by referring to the fact, usually ignored, that Mr. Darwin, of whose theory of natural selection the author is the most strenuous supporter, in the latest edition of his great work on the origin of species, spoke of life as being derived from a divine source. His exact words, as given by Mr. Wallace, who deserves great credit for allowing so fully the claim of Mr. Darwin to the discovery of that theory although it was simply a matter of prior publication, are as follows: "There is grandeur in this view of life, with its several powers, having been originally breathed by the Creator into a few forms or into one; and that, while this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning, endless forms most beautiful and most wonderful have been and are being evolved." It should be pointed out, however, that, as Mr. Wallace mentions, Darwin in a letter to Sir Joseph Hooker, written in 1863, states that in using the term "Creator" he meant "appeared by some wholly unknown process." He added: "It is mere rubbish thinking at present of the origin of life; one might as well think of the origin of matter." Such being the case, it is evident that the reference to the breathing of life by the Creator is merely a "poetical expression" and not intended to convey any idea of the method by which living forms originated.

Those who have not carefully studied Mr. Darwin's views are disposed to think that he regards natural selection as the only agency at work to give rise to new species and genera. As the author points out, this is a great mistake, as Mr. Darwin distinctly recognised the operation of "causes of which we are almost wholly ignorant, as we are of the nature of life itself." One of these causes, that of *variability*, is particularly discussed by Mr. Wallace, who replies to those who object to natural selection as producing new species owing to the enormous chances against the right kind of variation occurring just when required, that variation is "one of the most constant and universal facts of nature, always producing what may be termed the raw materials of species in overflowing abundance, so that, whenever and wherever alteration of the conditions of existence is going on, there is always ready to hand an ample stock of varying organisms, by means of which an almost exact adjustment to those conditions may be kept up." The author is careful, however, not to claim too much for variation and natural selection, by remarking that while individual variation with natural selection is adequate for the production of the separate species of one genus, of one family, or perhaps of one order from a common ancestor, "we have no proof and hardly any good evidence that it is adequate to initiate those important divergences of type which characterise" the separate orders, classes, and subkingdoms. And yet he affirms that the whole body of evidence clearly indicates that all alike have been produced by "descent with modification" from a few primitive types.

In his chapter on "The Method of Organic Evolution," Mr. Wallace points out that the modern doctrine of organic evolution dates from the time of Buffon, who maintained that Nature is in a "state of continual flux and movement," and that she can do all "except create matter or destroy it." These views as modified by Lamarck and other writers obtained considerable weight with the best thinkers, but not before Darwin had any one been able to show how "the wonderful and complex adaptations of living things to their environment could have been produced by means of known laws and through causes proved to exist and to be of sufficient potency." The four great facts on which his theory is based are variation, rapid multiplication, and the resulting struggle for existence, and survival of the fittest. By reference to these facts organic evolution is more easily explained than by the Lamarckian idea of the direct action of the environment on the organism. After the discussion of this question, the author proceeds to consider the theories of the Discontinuity of Species and of Organic Stability, originated by Mr. Bateson and Mr. Galton respectively, as substitutes for natural selection, partial or complete. These efforts to establish new methods of organic evolution he declares to have "completely failed to establish themselves as having any relation to the actual facts of nature," owing to the fact that attention has been devoted to one set of facts to the exclusion of others both more general and more important.

In a chapter devoted to the consideration of the "Problem of Utility" Mr. Wallace discusses the views expressed by Mr. Romanes in his work *Darwin and After Darwin*. In the preface to this work Mr. Romanes states that his arguments had "broken to fragments" the doctrine of utility, and had "made a full end thereof." In lieu of utility, he finds five causes of modification—climate, food, sexual selection, isolation, and laws of growth. Mr. Wallace in criticism of this view enforces the fundamental argument that "whereas every modification of a species which arises under the influence of natural selection must, from the very nature of its origin, be useful to the new form, no other agency has been shown to exist capable of producing utilitarian characters *in every individual constituting a species, neither more nor less.*" As to the particular causes spoken of by Mr. Romanes, he affirms that although climate and food produce modification in the individual it has not been proved that such modifications are hereditary. Sexual selection, the author declares, is only a form of natural selection, and sexual characters are therefore useful characters. Isolation he does not regard as a true cause; it is at most only an aid to the differentiation of new species by natural selection. Finally, the laws of growth cannot account for *specific* characters and the peculiarities with which they are concerned in higher groups must at first have had a utilitarian character. One of the questions here referred to is discussed in a separate chapter entitled "Are Individually Acquired Characters Inherited?" On the affirmative side of this question are ranged Mr. Darwin and Mr. Spencer, the other side being Mr. Francis Galton and Professor Weismann. Mr. Wallace considers in detail the most important arguments used in support of the proposition that individually acquired characters are inherited and he comes to the conclusion that the balance of evidence yet adduced is altogether the other way. Mr. Spencer's main arguments to prove the inadequacy of natural selection to account for certain modifications are, according to the author, inconclusive, "since they are either founded on comparatively unimportant and adventitious peculiarities, or on a neglect of some of the most important conditions under which natural selection in its various forms comes into play."

We can only name some of the remaining subjects discussed in the first volume of Mr. Wallace's important work. "The Group of Earth Studies" includes "The Permanence of Oceanic Basins," "Our Molten Globe," and "The Ice Age and Its Work." In the other groups we have valuable chapters on "Monkeys," "The Disguises of Insects," "The Distribution of Plants," particularly in North America, and the "Evolution and the Distribution of Animals." Under the head of Anthropology Mr. Wallace reproduces his Studies on the Polynesians, on the natives of New Guinea, and on the "Affinities and Origin of the Australian and Polynesian Races." All these chapters are well-illustrated. The space at our command will not allow us to enter into details on the subjects discussed by Mr. Wallace in his second volume. They are divided into Educational, Political, Ethical, Sociological, and the Land Problem. Most of the questions considered are treated of from the author's well-known socialistic standpoint. In a chapter on "Speech," which deserves careful consideration, Mr. Wallace associates the origin of spoken language with that of gesture language of which it is said to be a kind of imitation. The only place where he allows his spiritualistic views to reveal themselves is when discussing the question "Why live a Moral Life?" This he considers the Rationalist and the Agnostic has no adequate motive for doing, "except so far as he is influenced by public opinion and by a belief that, generally, it pays best to do so." The only adequate motive for a moral life he finds in the teachings of Spiritualism. This lame conclusion and his general argument on this topic seem to us to betray a sad deficiency of power to realise the real nature and conditions of the subject, which is surprising considering the power of reasoning and appreciation of difficult problems displayed in other portions of Mr. Wallace's work which will deservedly have a large number of readers.

C. S. WAKE.

LEÇONS DE CHIMIE PHYSIQUE PROFESSÉES À L'UNIVERSITÉ DE BERLIN. By *J. H. Van't Hoff*, Membre de l'Académie des Sciences de Berlin, Professeur ordinaire à l'Université et directeur de l'Institut de Physique de Charlottenbourg. Ouvrage traduit de l'allemand par *M. Corvisy*. Troisième partie: Relations entre les propriétés et la composition. Avec un portrait gravé de l'auteur. Paris: Librairie Scientifique A. Hermann. 1900. Pages, ii, 170. Price, 7 francs.

This work on the relations existing between the properties and the constitution of matter is a reproduction of the lectures which Professor Van't Hoff delivered at the University of Berlin in 1898 and 1899. It forms the third and last part of a treatise on physical chemistry, the first two parts of which, treating of chemical